



High productivity computing systems

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High Productivity Computing Systems

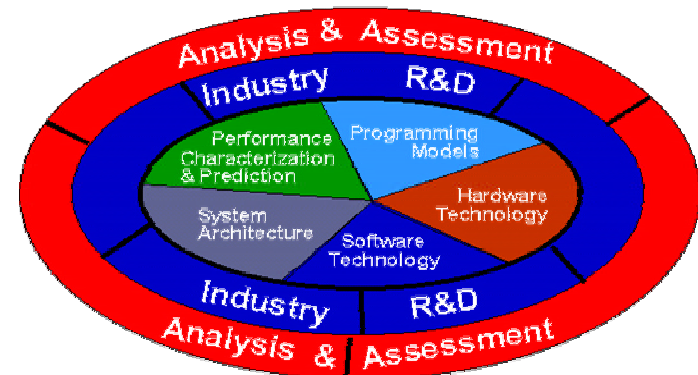


Goals:

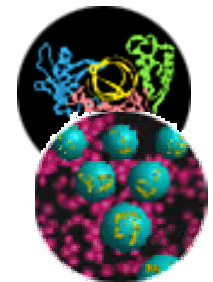
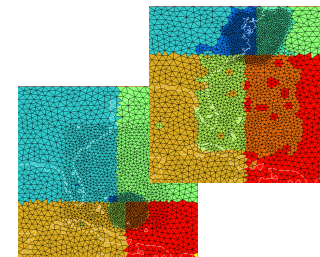
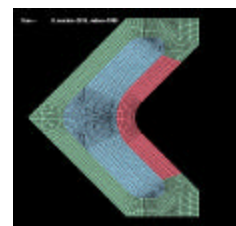
- Provide a new generation of **economically viable** high productivity computing systems for the national security and industrial user community (**2007 – 2010**)

Impact:

- **Performance** (efficiency): critical national security applications by a factor of 10X to 40X
- **Productivity** (time-to-solution)
- **Portability** (transparency): insulate research and operational application software from system
- **Robustness** (reliability): apply all known techniques to **protect against outside attacks**, hardware faults, & programming errors



HPCS Program Focus Areas



Applications:

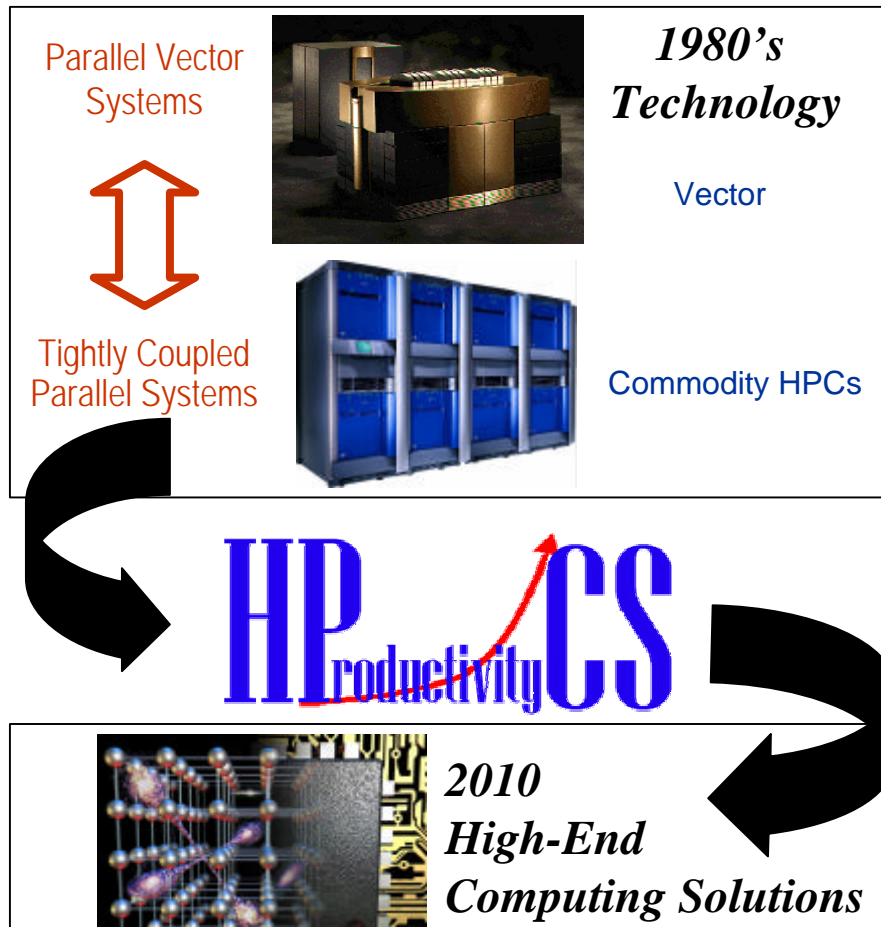
- Intelligence/surveillance, reconnaissance, cryptanalysis, weapons analysis, airborne contaminant modeling and biotechnology

Fill the Critical Technology and Capability Gap

Today (late 80's HPC technology).....to.....Future (Quantum/Bio Computing)



HPCS Objectives



*Moores Law
Double Raw
Performance every
18 Months*

*New Goal:
Double Value Every
18 Months*

*Fill the high-end computing technology and capability gap
for **critical national security missions***



Computing Metric Evolution



Early Computing Metrics

- ◆ Clock frequency
- ◆ Raw performance (flops)

GHz Race

Current Computing Metrics

- ◆ Clock frequency
- ◆ Point performance
- ◆ Acquisition Price

Emerging Scalable Benchmarks

HPCS “Value” Based Metrics

- ◆ System performance relative-to-application diversity
- ◆ Robustness (includes security)
- ◆ Mean time-to-recovery
- ◆ Idea-to-solution
- ◆ Time-to-solution
- ◆ Application life cycle costs
- ◆ Ownership (facilities, support staff, training) costs
- ◆ Acquisition (facilities and equipment) costs
- ◆ Scalability (flops-to-petaflops)
- ◆ Evolvability



HPCS Technical Considerations



Communication Programming Models

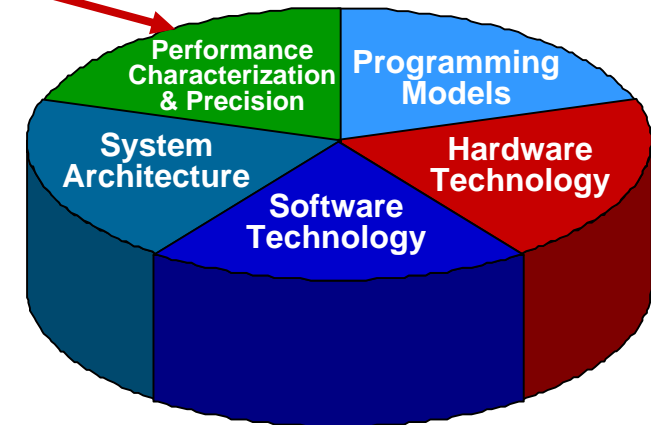
Shared-Memory
Multi-Processing

Distributed-Memory
Multi-Computing
“MPI”

Architecture Types

Custom Vector	Microprocessor
Parallel Vector	Symmetric Multiprocessors Distributed Shared Memory
Scalable Vector	Massively Parallel Processors Commodity Clusters, Grids
Vector Supercomputer	Commodity HPC

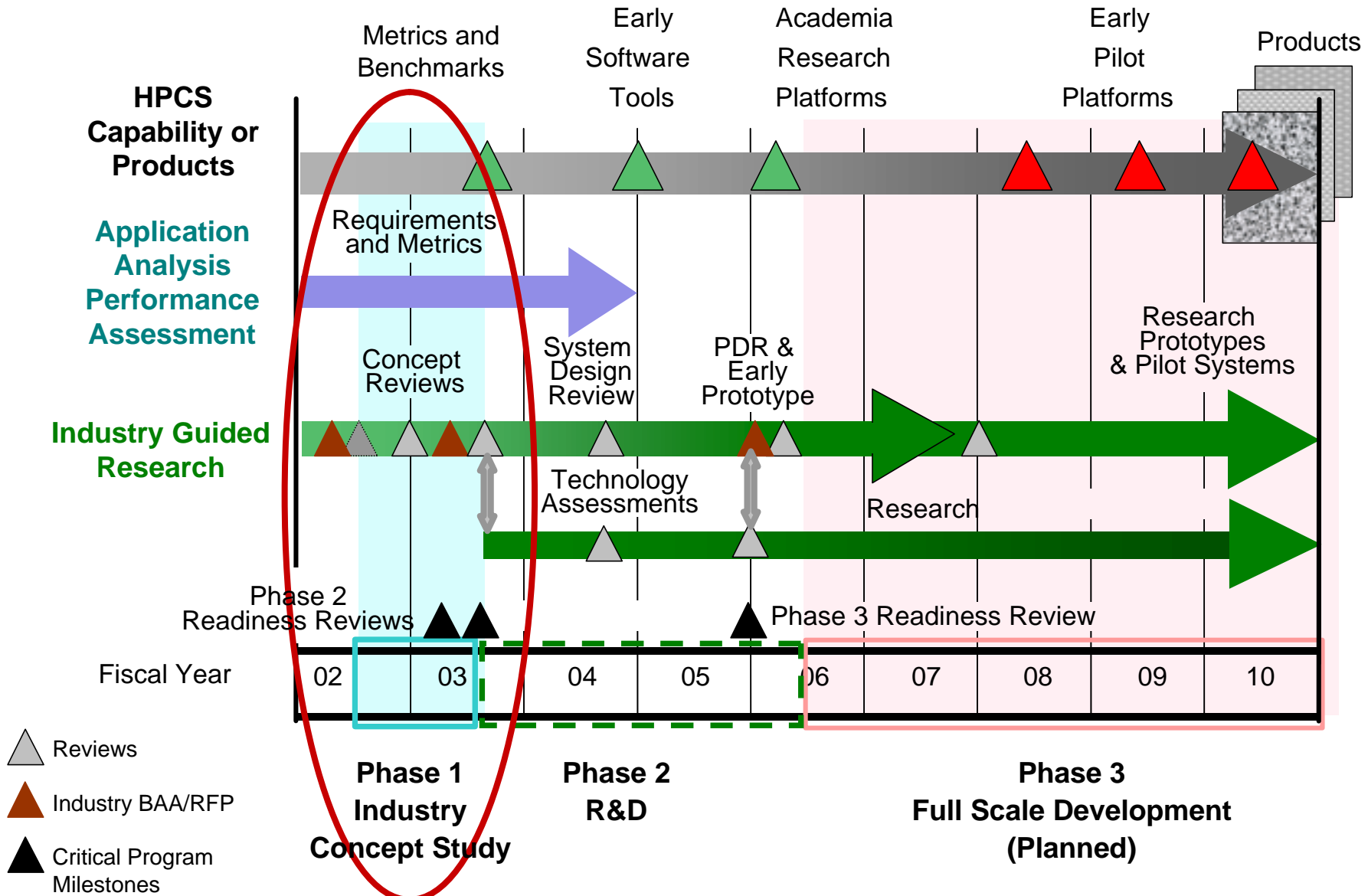
HPCS Focus
Tailorable Balanced Solutions



**Single Point Design Solutions are no longer
Acceptable**



HPCS Program Phases 1-3





Phase I Output



- ◆ Develop HPCS conceptual pilot system technical description targeted for implementation by 2008 to 2010 in accordance with Tasks 1-6.
 - Define revolutionary system in terms relative to current product line
 - Quantify HPCS performance, productivity, portability, and robustness objectives
 - Quantify HPCS technical objectives: (1) High effective bandwidth/low latency; (2) Balanced system architecture; (3) Robustness; (4) Performance measurement/prediction; (5) System tailorability

Technology Components

- 1) System Architecture
- 2) Programming Models
- 3) Software Technology
- 4) Hardware Technology

Application Analysis and Performance Assessment

- 5) Performance Characterization & Prediction
- 6) HPCS Application Productivity Analysis



Phase I Output (cont'd)



- ◆ Quantify “Value” for proposed solution across HPCS application regions with suggested measurement techniques.
- ◆ Define In context “Value” metrics for both HPCS applications and vendor markets.
- ◆ Provide supporting simulations, analysis, experiments, and demonstrations as required.
- ◆ Address Phase 2&3 technical, programmatic, and market risks.
 - Phase 2&3 program plan with a recommended technology freeze point.
 - Identify critical technologies to be addressed in Phase 2.
 - Provide university and end user early technology coordination and transition plan.



Phase I HPCS Industry Teams



- **Cray, Incorporated**
- **International Business Machines Corporation(IBM)**
- **Silicon Graphics, Inc. (SGI)**
- **Sun Microsystems, Inc.**
- **Hewlett-Packard Company**

